THE COASTAL INTERFACE[1]

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Even though landings of commercial fish from U.S. waters have not increased in recent years, there has been a shift in the source of supply. An example of this is the increase in fishery production from the Gulf of Mexico. In 1940 the Gulf contributed only 6% (250 million pounds) of the total U.S. production, whereas in 1968 the Gulf contributed 31% (over 1.2 billion pounds). Likewise, the commercial fishery in Texas is expanding. In 1968, fishermen caught 149 million pounds valued at more than $44 million from the coastal waters of Texas. Remember that this is dockside value and when projected to consumer level it would assert a capital input to the economy several-fold greater. While Texas ranked only 10th nationally in terms of volume, it ranked 3rd in the value of the catch because of its shrimp resources. Principal species in the commercial harvest from the Gulf area were shrimp, menhaden, oysters, and crabs. These four species accounted for about 90% of the total value.

Saltwater sport fishing is becoming very popular. To help illustrate the value of the sport fishing industry, a 1965 National survey found that saltwater sport fishing generated nearly $800 million of gross business activity. It was comprised primarily of: fishing equipment, auxiliary equipment, food and lodging, transportation, licenses, bait, guides, and other miscellaneous items.

Statistics indicated that saltwater anglers on the Gulf coast spend, on an average, nearly $8.00 per day. It was estimated that the coastal waters of Texas provide over 8 million man-days of sport fishing annually. With expected population growth, more leisure time, and better transportation and equipment, considerable increase in recreational fishing is anticipated. Again referring to the National survey, 10-year trends of increasing participation in saltwater fishing were compared with the population growth trend of the entire United States. Saltwater angling

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down by bacteria into detritus. Animals at the bottom of the food chain feed by filtering this detritus from the water in great quantities. These are the shellfishes, the planktonic crustaceans, and the schooling bait fishes. These, in turn, are eaten by large fishes, crabs, and so forth through the complex food chain.

Another obvious value of the estuarine zone, and one that it alone can supply, is enrichment of the open coastal waters. There is good reason that fish and shellfish are most abundant near the coasts of our oceans.

Nature has contrived to fill all the available living space in creating life in the sea. In the shallow estuarine zones she has been particularly ingenious. Over eons of time, nature has perfected fish species to take advantage of every variety of inshore habitat. Because each marine fish species has adapted its life cycle in a special way to fit special conditions, it has lost the ability to prosper in any other habitat. This specialization is a one-way street leading to success for the species only as long as there is no catastrophic change in its living area.

The survival technique adopted by each species to thwart its natural enemies is not worked out at the time of danger but rather it is an automatic, instinctive reaction. For any organism the strategy evolves, in general, from its whole life history pattern, but more specifically from the special type of habitat to which it is adapted.

Man's historic economic development has been closely linked to estuaries because of their strategic location, and, as a result, they are being extensively altered or destroyed. The Gulf Coast of Texas is experiencing exceptional economic growth. The problem is basically people. As more people occupy the coastal zone, the problems intensify. As our technology grows, the characteristics of the waters are being changed by domestic, agricultural, and industrial uses. The effects of various chemical changes, which produce massive fish kills that can be seen and smelled by the layman, often stirs up sufficient public opinion to initiate remedial action. However, we are as much or more concerned with some of the more subtle effects of pollution. We readily admit that much is yet to be learned about the effects of pollution, but small pieces of evidence from individual scientific experiments tell us that the foreign substances added to the water can affect marine life in many ways without killing. Changes in water quality may affect growth rates, length of life, reproductive capacity, and resistance to diseases, just to mention a few. In the long run, these inconspicuous effects may be more disastrous than those which pile up masses of dead fish on a beach.

I would also like to point out our concern with the many physical alterations taking place in estuaries. Specific activities which pose a threat to the coastal environment include bulkheading and filling; dredging of channels and fossil shell deposits; stream diversions; and restriction of tidal exchange and fresh-water runoff. Effects from a single one of these is usually small, but because they are so numerous,

increased at an average rate of 6% per year while the total U.S. population grew at an average rate of only 2% per year.

As you can well see, the value of sport fishing alone to the Texas coast is big business and contributes significantly to the economy of the State. The more popular species sought after are sea trout, redfish, flounder, croaker, black drum, and others.

Each of the commercially important species mentioned earlier and each of the sport fishes just named have one thing in common--they are all estuarine dependent. This means that they are required to spend either all or part of their life cycle in an estuary. Most of these estuary-dependent species spawn in the Gulf. The young enter the estuary when very small, inhabit areas to which they are best suited, and proceed to grow very rapidly. They return to the Gulf in a few weeks or months and complete their development. For example, brown shrimp spawn offshore in the Gulf and the young are about 1/2 inch long when they enter an estuary in the spring. By late May or early June they are about 4 inches long and return to the Gulf where they complete their development and the cycle.

For those of you who may not be acquainted with the term estuary, I will give you a very brief definition. The typical estuary is a coastal body of water that is semienclosed and has an input of fresh water at its head and tidal exchange with the sea or gulf. It usually has a well-defined salinity gradient between the river and the sea and is therefore unique in that it is neither like the river nor the sea. It is usually characterized by a broad spectrum of conditions throughout which many species requiring different environmental conditions can be accommodated simultaneously.

Those of you who are sport fishermen or duck hunters have heard a great deal about estuaries lately. Unfortunately, there are many well-intentioned people who have traditionally looked on wetlands as wastelands or lands that are sitting there doing nothing and serving no purpose. The layman often views the marshes as areas of muck, shifting sands, pungent odors, mosquitos, creeping and crawling creatures, strange sounds in the night, and lonely solitude in the day.

The fact of the matter is that estuaries are among the most fertile areas in the world. For example, a production or crop of 10 tons of dry organic matter per acre per year can be expected from marshlands. In comparison, world wheat production is only 1 1/2 tons per acre (whole plant) and only certain, very rich sugar cane and rice areas produce as much as our fertile marshlands and estuaries, and the marshes are not fertilized artificially.

Plant life occurs in the estuarine zone as attached grasses, algae, and phytoplankton. The plant production, although of little use to man directly, supplies basic food for the young and small fishes and invertebrates. The larger plants die, are detached, decomposed, and broken

their compound effects are unquestionably producing major environmental changes.

Like the effects of pollution, some environmental alterations have obvious detrimental effects on marine life. It is not difficult to recognize the adverse effects of silt deposition on an oyster bed. For instance, the living oysters are smothered and die, and the bottom is made unsuitable for future generations of oysters. Nor is it difficult to recognize the adverse effects of spoil deposition or land fill that physically displaces habitat or acts as an isolation barrier and prevents utilization by marine organisms. Some of the effects of engineering activities have much of the subtleness found in agricultural, industrial, and domestic pollution. Environmental changes that are less dramatic would be alteration in water circulation patterns, changes in salinity or temperature of the water, as well as numerous other conditions which may or may not be harmful to fishery resources. For example, water temperature and salinity are two of the more potent physical factors in the life of marine and brackish water organisms. There is a complex correlation between the biological effects of temperature and salinity. Temperature can modify the effects of salinity on an organism, i.e., salinities tolerated by an organism at a high temperature may vary from those tolerated by the same organism at a low temperature. Conversely, salinity can modify the effects of temperature.

Biologists are not against progress and development. In fact, I do not know of any true conservationist who is against them. But many of the estuarine modifications undertaken in the name of progress are not really progressive. Much of the environmental destruction and pollution can be avoided. I feel that progress need not be despoliation or degradation; development can be guided to protect maximum overall values.

There are alternatives or other ways for municipalaties, industries, farmers, engineers, and planners to develop their goals or meet their objectives. Development can take place without the sacrifice of natural values and esthetics. However, once a natural resource has been despoiled and altered, the change is usually irrevocable.

The incentive for anyone to try to alter these coastal areas, almost without exception, is the fast dollar. The fate of our total natural environment is under constant economic pressure. For too long we have scrambled furiously for the dollar, which represents comforts, conveniences, and fun, without pausing to total up the cost. The economic benefits of most dredging, filling, and polluting operations are recognizable and are fairly easy to measure. But the economic losses are difficult to assess. We do not yet know how to determine and assign values to the intangibles of a quality environment such as natural beauty, recreation, fish, wildlife, etc. We remain at the mercy of development accounting which measures costs against benefits and excludes the cost of degrading the environment or the benefits of leaving the environment alone.

Increasingly, people are building resort or vacation homes in this area to enjoy the hunting, fishing, and esthetics provided by the natural estuarine environment and its associated marshes. These building developments usually depend on the dredging of marshes for access channels and utilization of the spoil to fill lowlands to such an elevation that it can be sold as building lots. It is conceivable that after the developments are all completed, the occupants of the houses will have a waterfront view and a cool breeze to enjoy, but the fish and waterfowl could be gone forever.

These estuarine wetlands and tidal areas are owned by the public and their rights and interests should take precedence over the rights of private individuals to profit at public expense. This is not to say, for example, that some lands should not be filled or wetlands converted to the culturing of a single species. Such projects, however, should be carefully considered and held to a bare minimum, strictly controlled, and approved only after clear-cut demonstration that they will advance or maintain the public good. It may often be better to postpone shoreline or tidal area developments or to divert them to inland areas than to cause permanent damage in haste.

The effects of resource development on fish and wildlife have received some national recognition, and legislation was enacted to provide a means for considering these resources in all Federally planned and Federally authorized water-development projects. Implementation of this legislation authorized and obligated the U.S. Fish and Wildlife Service to assist and cooperate with other Federal, State, and public or private interests in planning the development of our water resources. The Bureau of Sport Fisheries and Wildlife, Division of River Basin Studies (DRBS) was designated the representative of the U.S. Fish and Wildlife Service in connection with Federally planned and authorized water-development projects.

Work contemplated by private or non-Federal interests in navigable or tidal waters requires a permit from the U.S. Army Corps of Engineers. In accordance with the previously mentioned legislation, the Fish and Wildlife Service is responsible for advising the Corps of possible adverse effects that the proposed work might have on fish and wildlife resources. Since the DRBS represents the interests of both Bureaus of the Fish and Wildlife Service, it is imperative that it cooperate closely with the Bureau of Commercial Fisheries whenever significant commercial fisheries are involved.

Our primary goal in BCF is to assure that estuary-dependent fishery resources receive consideration and protection during project planning. To achieve this goal we review each of the Federally planned as well as privately planned projects (over 400 annually) that potentially affect the estuarine zone in the western Gulf of Mexico. When warranted, we recommend measures to reduce adverse effects and where practical recommend changes whereby the environment would be enhanced for fishery resources. To develop the best possible evaluation of each proposed project, we obtain assistance from other BCF scientists, economists, and statisticians, as well as all other available sources of information.

Because fishery resources are, in general, the property of the State, we consult directly and work closely with the appropriate conservation agency relating to technical aspects of fishery investigations associated with water-development projects.

Upon receipt of our recommendations, the Corps reviews them with the applicant to insure that they are encorporated in his plans. Developers often come to us for suggestions prior to submitting their application to the Corps. This procedure usually saves the developer much time because he is made aware of our views before he actually submits his application.

We also have another estuarine program studying the basic estuarine ecology. General objectives of the program are to:

(1) Compare productivity of natural estuarine habitats with areas altered by dredging, spoiling, bulkheading, and filling.

(2) Document the effects of specific types of construction on the estuarine environment.

(3) Develop techniques for managing estuarine habitats for increased fishery production.

(4) Develop methods for rehabilitating altered habitats so that productivity can be reestablished.

If the estuarine areas so necessary for perpetuation of the sport and commercial fishing industries are to be preserved, it is important that action programs be implemented immediately to protect the natural qualities of estuaries and their contiguous zones. Presently, there is a battle going on between preservation-conservation and development in most of our estuaries. Development is proceeding so rapidly that there will be little left to preserve and conserve when we finally learn how to manage estuaries for multiple use.

Closer coordination and unanimity of purpose among agencies of all levels of government with interests in these areas must be encouraged. The public sector must take the initiative to develop plans and enforceable regulations that can cope in an orderly fashion with the increasing demand for alteration of land and water in estuaries. Also, there must be an informed public, willing to support policies and costs that lead to the sound management of our estuarine and coastal zones.